4.2

May 4, 2017 1:12 PM

4.2 Scale Diagrams

on map 1 : 1,200,000

If you look at a map you may see something that says 1cm represents 12km.

Scale is a comparison between the actual size of an object and the size of its diagram. It can be expressed as a ratio, as a fraction, as a percent, in words, or in a diagram. In the above example of the map what is the scale as a ratio and a fraction?

1:12

ratio: 1 cm : 12 km
1 cm : 1200000 cm

fraction $\frac{1\text{ cm}}{12\text{ km}} = \frac{1}{1200000}$

A **scale diagram** is a drawing that is similar to the actual figure or object. It may be smaller or larger than the actual object, but must be in the same **proportions**.

Proportion: is a relationship that shows two ratios are equal. It can be written in fraction or ratio form.

- The corresponding parts of each ratio must be in the same units.

$$scale = \frac{diagram\ measurement}{actual\ measurement}$$

most reduced

Warm-up 1: Find the missing numerators and denominators, then write the equivalent ratios.

fractions: $\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8} = \frac{100}{200} = \frac{25}{50} = \frac{72}{144} = \frac{10.5}{21} = \frac{1}{2}$

ratios: $1:2 = 2:4 = 3:6 = 4:8 = 100:200 = 25:50 = 72:144 = 10.5:21$ (×3)

Warm-up 2: Complete the chart.

Fraction	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{2}$	$\frac{1}{50}$	$\frac{1}{1}$	$\frac{2}{10} = \frac{1}{5}$
Ratio	1:4	1:8	1:2	1:50	1:1	2:10 1:5
Percent	1÷4 ×100 = 25%	1÷8 ×100 12.5%	50%	2%	100%	20%
Decimal	1÷4 = 0.25	1÷8 = 0.125	0.5	0.02	1	0.2

Example 1: State whether you would multiply or divide to determine the missing value. Then find the missing value in each proportion.

(×250)

a) $\frac{1}{2} = \frac{x}{250}$ (×250)

Math 9 Foundations

$\frac{250}{2} = x = 125$

b) $\frac{1}{14} = \frac{3.2}{y}$ (×14, ×1)

$\frac{1}{44.8} = \frac{1}{y}$

or

$1 = 14$

c) $\frac{1}{z} = \frac{6.3}{24.9}$

Revised from Mrs. Epp and Mrs. Wong

$\frac{z}{1} = \frac{24.9}{6.3}$

$z = 3.95$

d) $\frac{1}{0.25} = \frac{w}{6.25}$ (6.25×, ×6.25)

$\frac{6.25}{0.25} = w$

$25 = w$

$z = 3.95$ $25 = w$

or

$$\frac{1}{3.2} = \frac{14}{y}$$

$$14 \times \frac{3.2}{1} = \frac{y}{14} \times 14$$

$$44.8 = y \checkmark$$

Page 5

May 4, 2017 1:13 PM

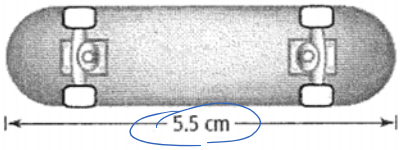
Example 2: Calculate the missing value in each proportion.

a) $\frac{1}{8} = \frac{78}{624}$ ×624 b) $\frac{1}{50} = \frac{25.2}{1260}$ c) $\frac{1}{0.6} = \frac{58}{34.8}$ d) $\frac{1}{80} = \frac{15.3}{1224}$

$\frac{624}{8} = \frac{78}{624}$ $25.2 \quad \frac{50}{1} = \frac{\square}{25.2} \times 25.2$ $58. \quad \frac{0.6}{1} = \frac{1}{58} \times 58$ $\frac{\square}{1} = \frac{1224}{15.3}$

Using Scale to determine the actual length of an object

The scale diagram of a skateboard uses a scale of 1:14. What is the actual length of the skateboard?



scale = $\frac{\text{diagram}}{\text{actual}}$

Method 1: Use the scale ×logic

actual skateboard is 14× the image

14 × 5.5 cm = 77 cm

Method 2: Use a Proportion

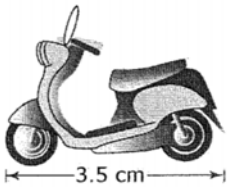
$\frac{\text{diagram}}{\text{actual}} \quad \frac{1}{14} = \frac{5.5}{a}$

$5.5 \times \frac{14}{1} = \frac{a}{5.5} \times 5.5$

a = 77 cm

Example 3: Calculate the actual length of each object.

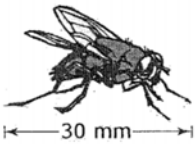
a) The scale for the image of the scooter is 1:20.



20 × 3.5 cm = 70 cm

$\frac{1}{20} = \frac{3.5}{a}$

b) The scale for the enlarged image of the housefly is 1:0.3.



$\frac{1}{0.3} = \frac{30\text{mm}}{a}$

$30 \times \frac{0.3}{1} = \frac{a}{30} \times 30$

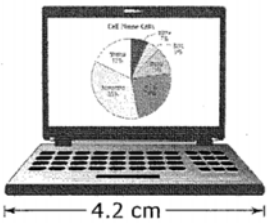
a = 9 mm

Example 4: Determine the scale factor.

a) 0.5 $= \frac{53}{106} = \frac{1}{2}$ b) 0.06 $= \frac{0.9}{15}$ c) 0.02 $\square = \frac{17}{850}$ d) 0.25 $\square = \frac{6.2}{24.8}$ e) 0.75 $= \frac{18}{24} = \frac{1}{1.3}$

Example 5: An actual laptop has a width of 39.5 cm. Calculate the scale factor used in the image of the laptop. Express the answer to the nearest tenth.

scale = $\frac{\text{diagram size}}{\text{actual size}} = \frac{4.2\text{cm}}{39.5\text{cm}} \cong 0.1 = \frac{1}{10}$



… 4.3

May 4, 2017 1:13 PM

Example 6: The flying distance from Dawson City to Whitehorse is 540 km. The distance shown on the map is 3 cm.

actual — image

$\frac{3\text{cm}}{540\text{km}} = \frac{1\text{cm}}{a} \rightarrow \frac{540}{3} = \frac{a}{1} = 180$

a) Complete the following to express the map scale in words. Scale: 1 cm represents 180 km

b) What is the scale factor? Hint: 1 km = 100 000 cm

1 cm : 180 km need same units

convert 180 km into cm

$180\text{km} \times \frac{100\,000\text{cm}}{1\text{km}} = 18\,000\,000$

or $\frac{1}{18\,000\,000} = 0.000000055$

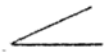
1 : 18 000 000

ASSIGNMENT 4.2 pg 142 # ~~1, 2,~~ 4-9, 10 or 11, 12, ~~13~~, ~~14ab~~, ~~15~~, ~~16~~, ~~17~~, ~~18~~, ~~(19, 21)~~

4.3 Similar Triangles

GEOMETRY VOCABULARY

Angle Properties


Acute ∠


Right ∠


Obtuse ∠


Straight ∠


Complementary ∠s add to 90°


Angles at a point add to 360°

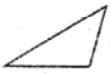

Supplementary ∠s add to 180°

Vertically opposite ∠s are equal


Angles on a line add to 180°

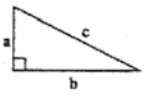
Triangle Properties

∠ sum of a triangle is 180°


Scalene triangle
— no sides equal
— no ∠s equal


Equilateral triangle
— 3 sides equal
— 3 ∠s equal (each 60°)


Isosceles triangle
— at least 2 sides equal
— ∠s opposite the equal sides are equal



Right triangle
— 1 right angle
— hypotenuse is opposite the right angle
— Property of Pythagoras
$a^2 + b^2 = c^2$